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Chothave et al.

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(54) **SIDE PANEL ASSEMBLY FOR ROOF TOP UNITS**

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F24F 13/28 (2006.01)
F24F 13/30 (2006.01)

(52) **U.S. Cl.**

CPC ***F24F 13/32*** (2013.01); ***F24F 13/20*** (2013.01); ***F24F 13/28*** (2013.01); ***F24F 13/30*** (2013.01); *F24F 2221/16* (2013.01)

(58) **Field of Classification Search**

CPC .. F24F 13/32; F24F 13/20; F24F 13/28; F24F 13/30; F24F 2221/16

See application file for complete search history.

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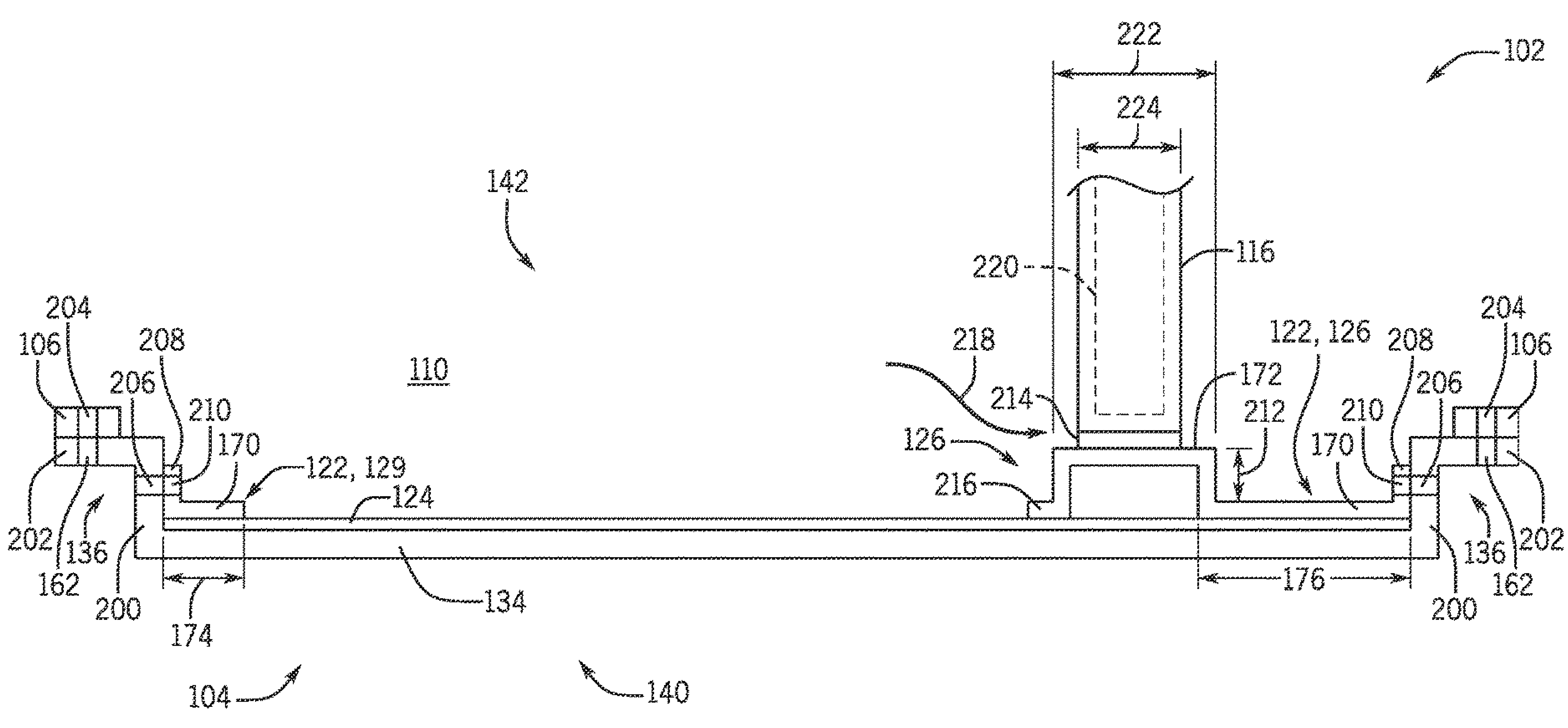
(57) **ABSTRACT**

A wall panel assembly for a heating, ventilation, and air conditioning (HVAC) unit includes a panel having a main body, where the panel is configured to be fastened to a frame of the HVAC unit, and a plurality of stiffeners attached to the panel along a perimeter of the main body. A stiffener of the plurality of stiffeners includes a flat portion and a raised portion offset from the flat portion, where the raised portion is configured to sealingly engage with a component disposed within the HVAC unit.

20 Claims, 9 Drawing Sheets



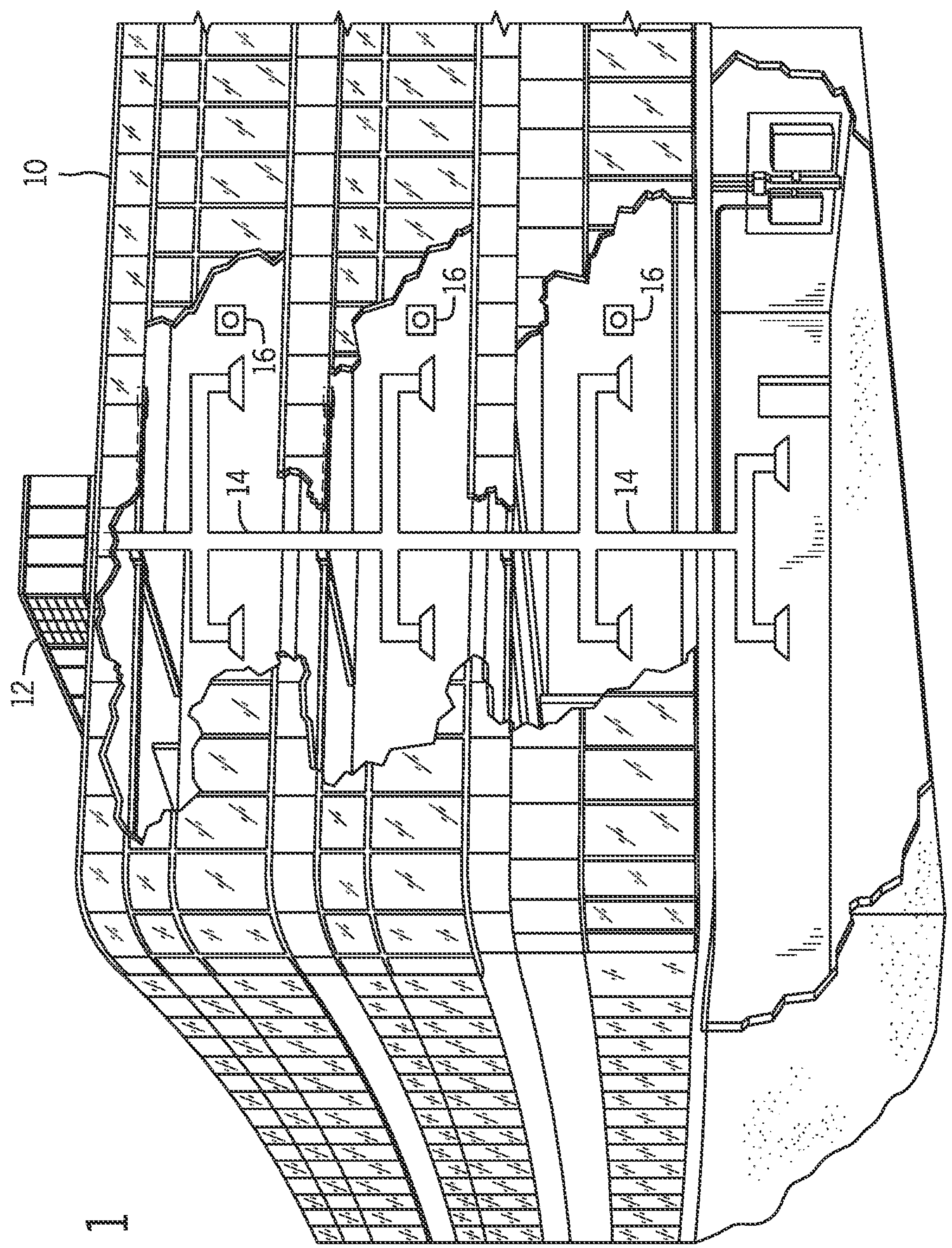


FIG. 1

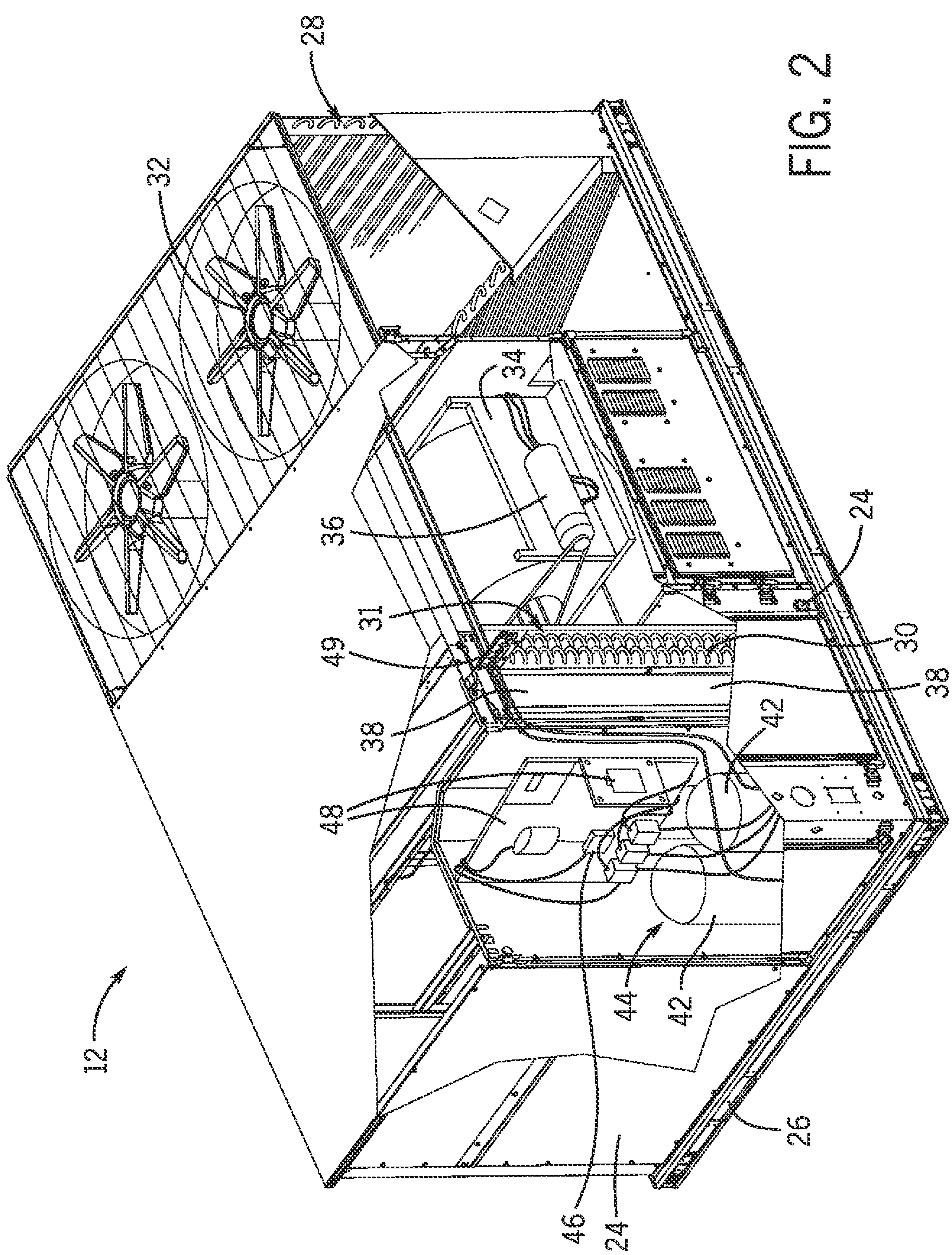


FIG. 2

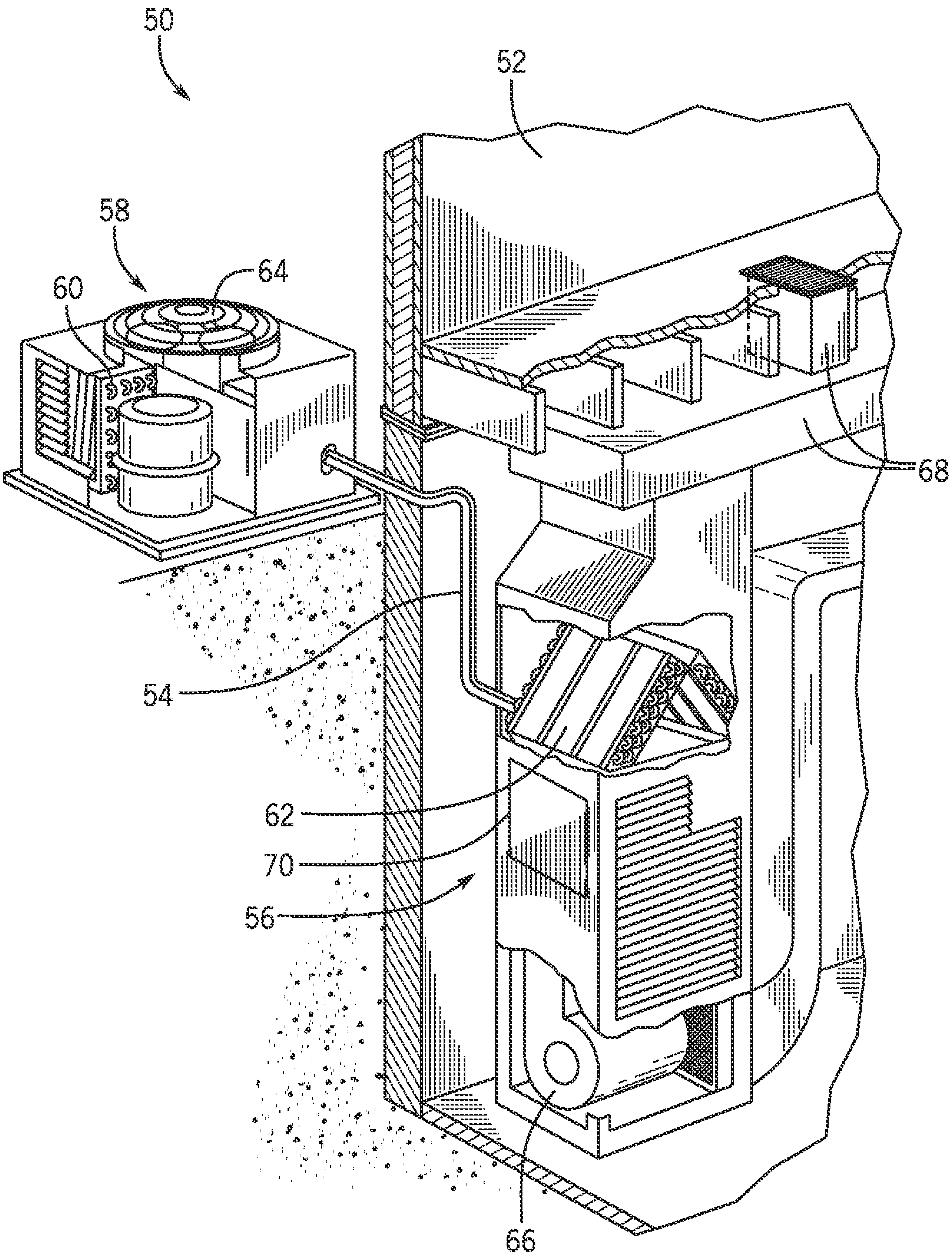
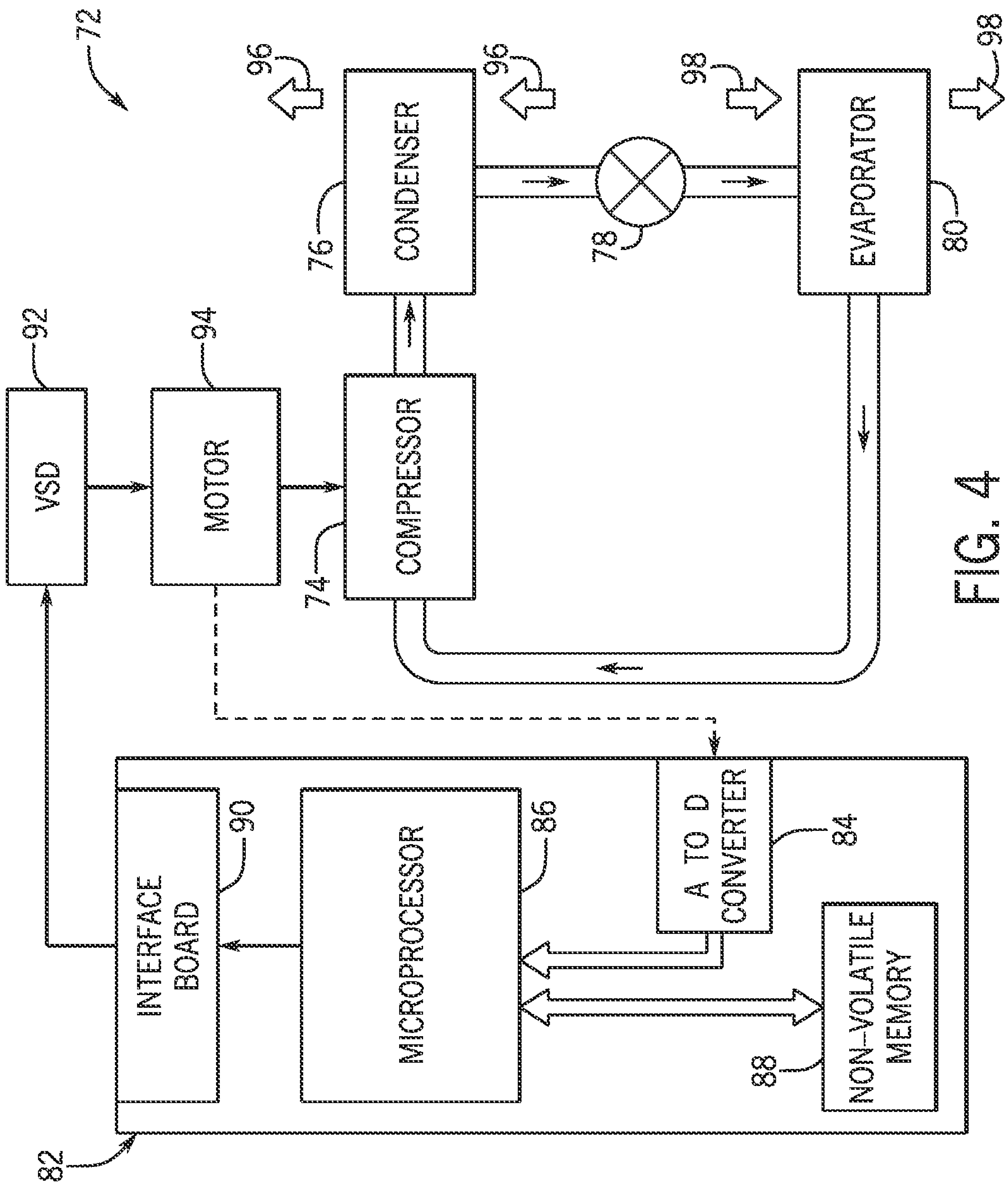


FIG. 3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VSD
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MOTOR
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COMPRESSOR
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CONDENSER
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98
EVAPORATOR
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INTERFACE BOARD
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MICROPROCESSOR
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A TO D CONVERTER
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NON–VOLATILE MEMORY
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82

FIG. 4

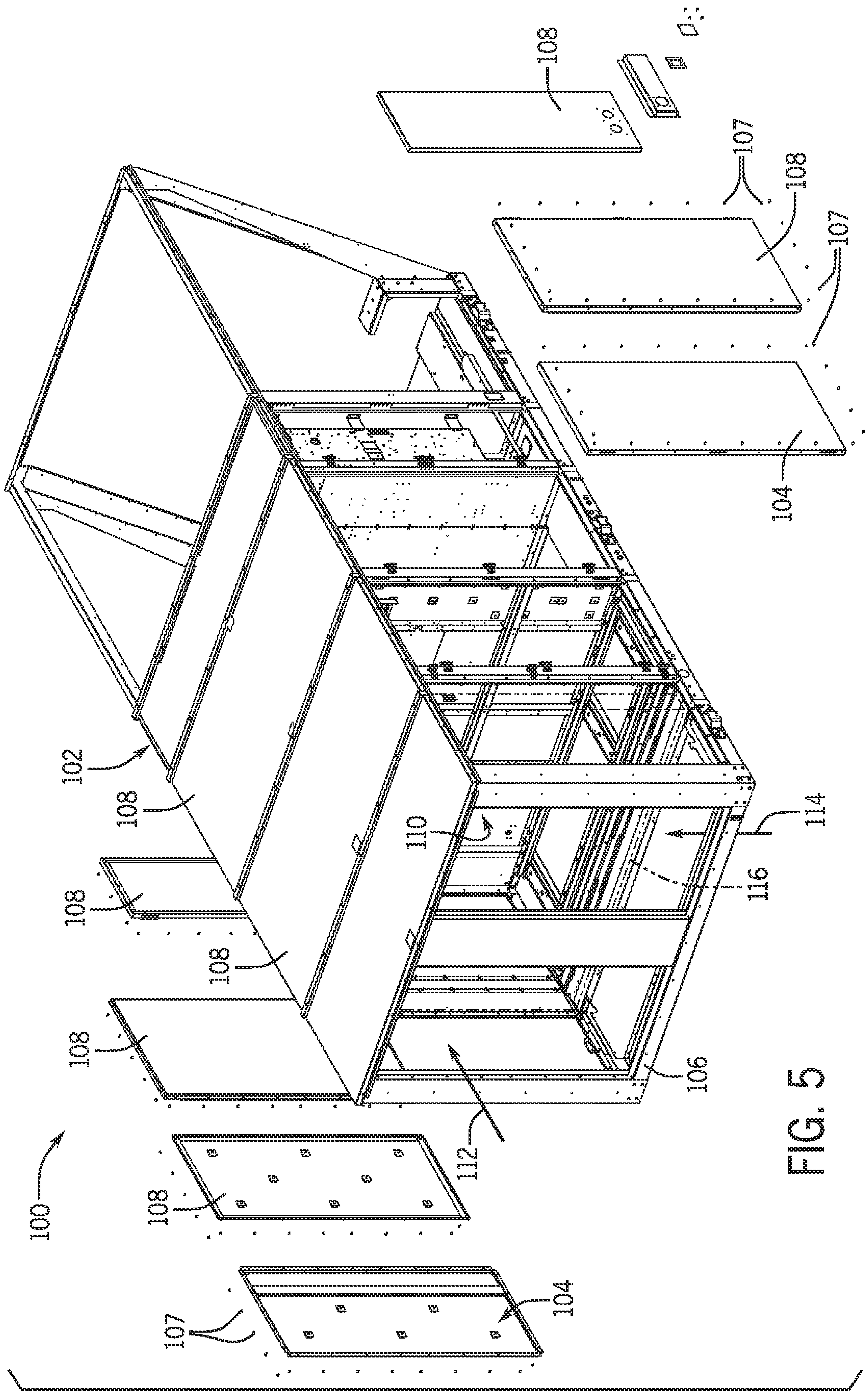

FIG. 5

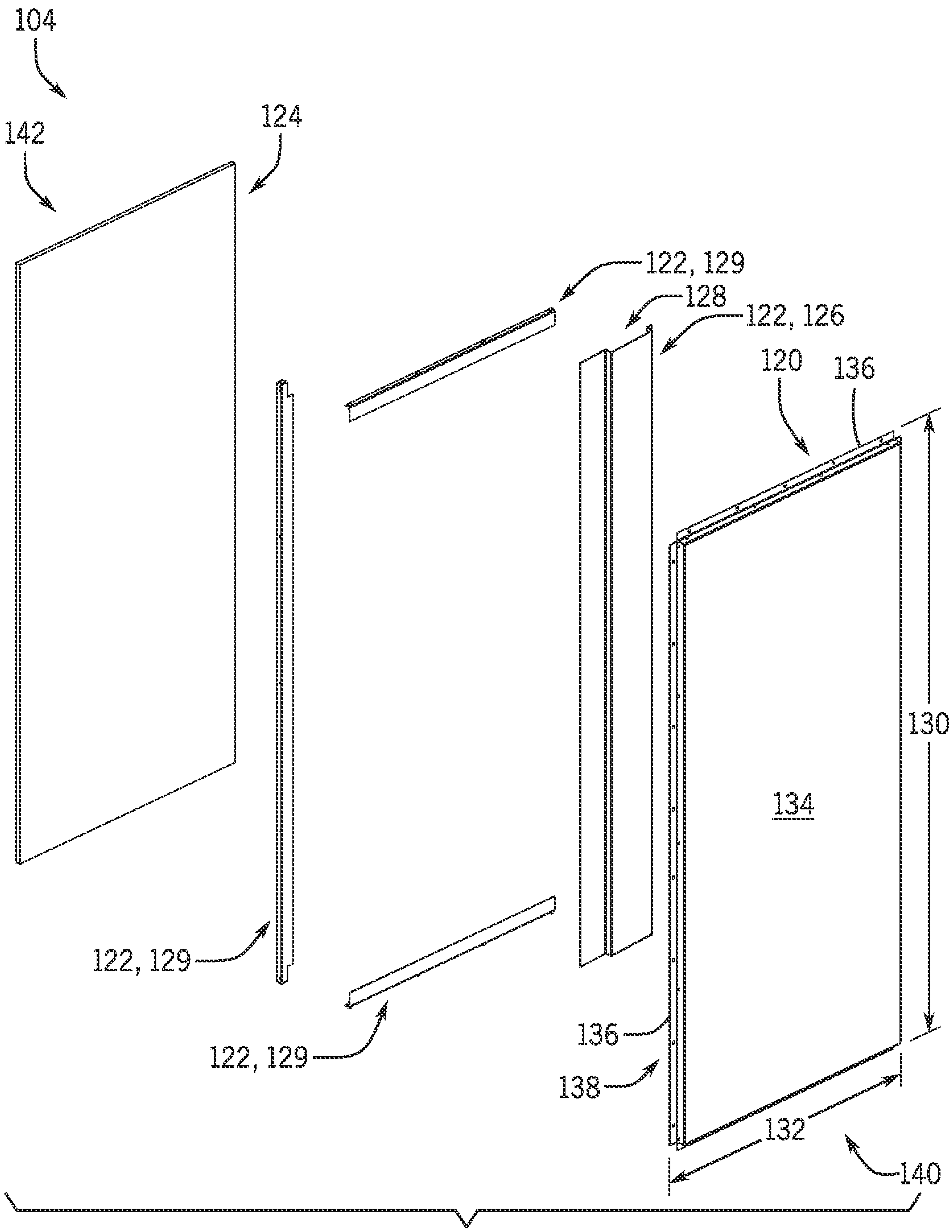
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FIG. 6

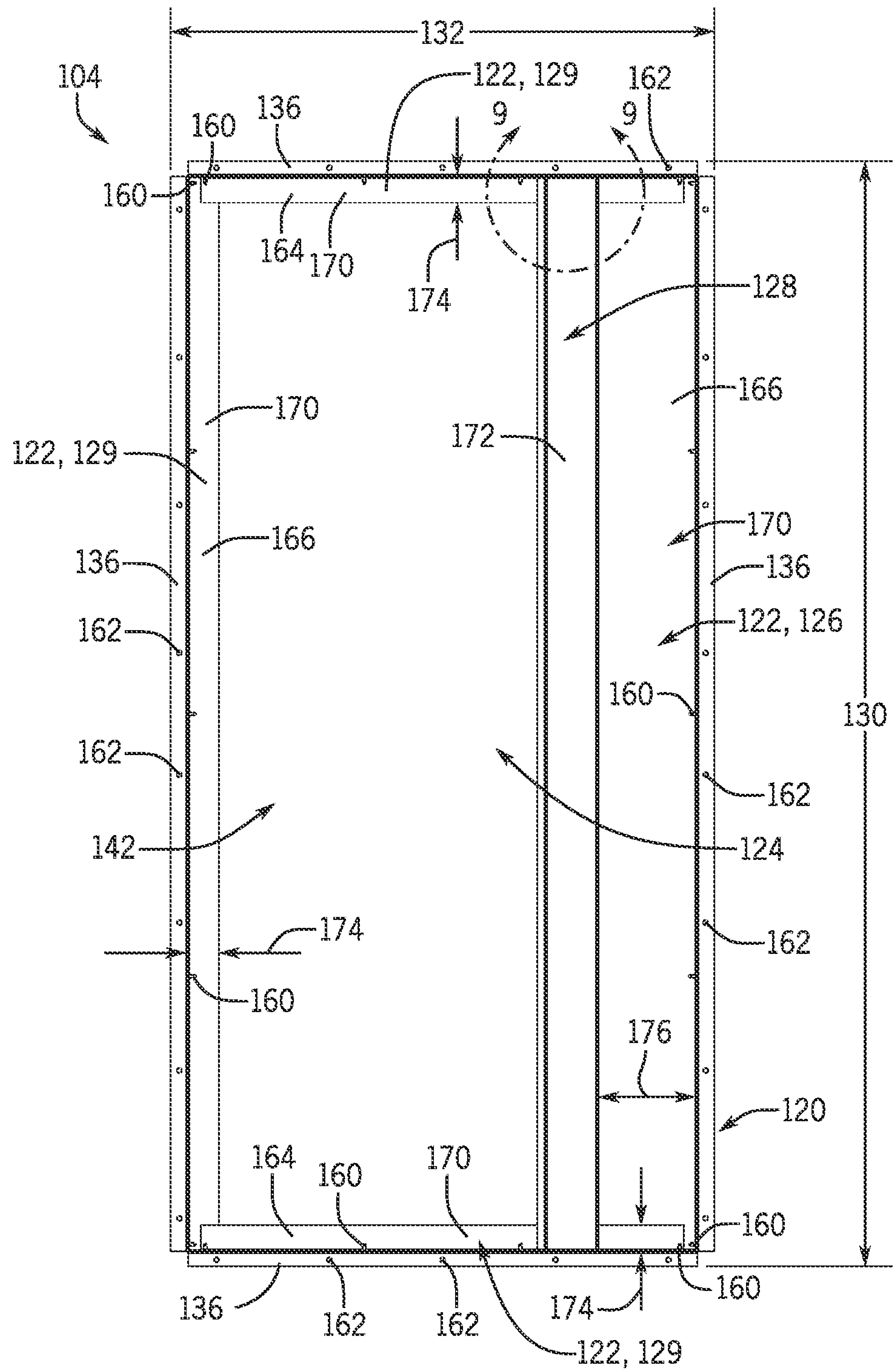
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FIG. 7

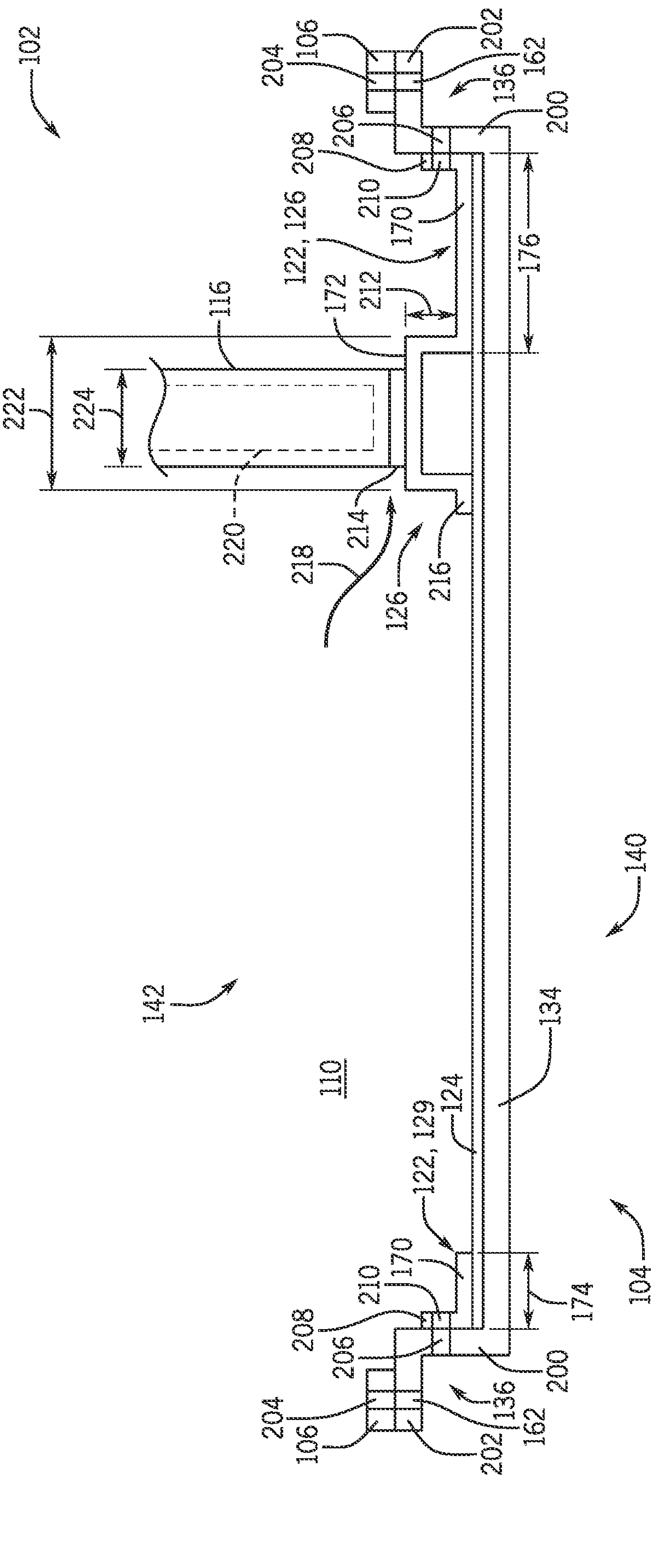
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FIG. 8

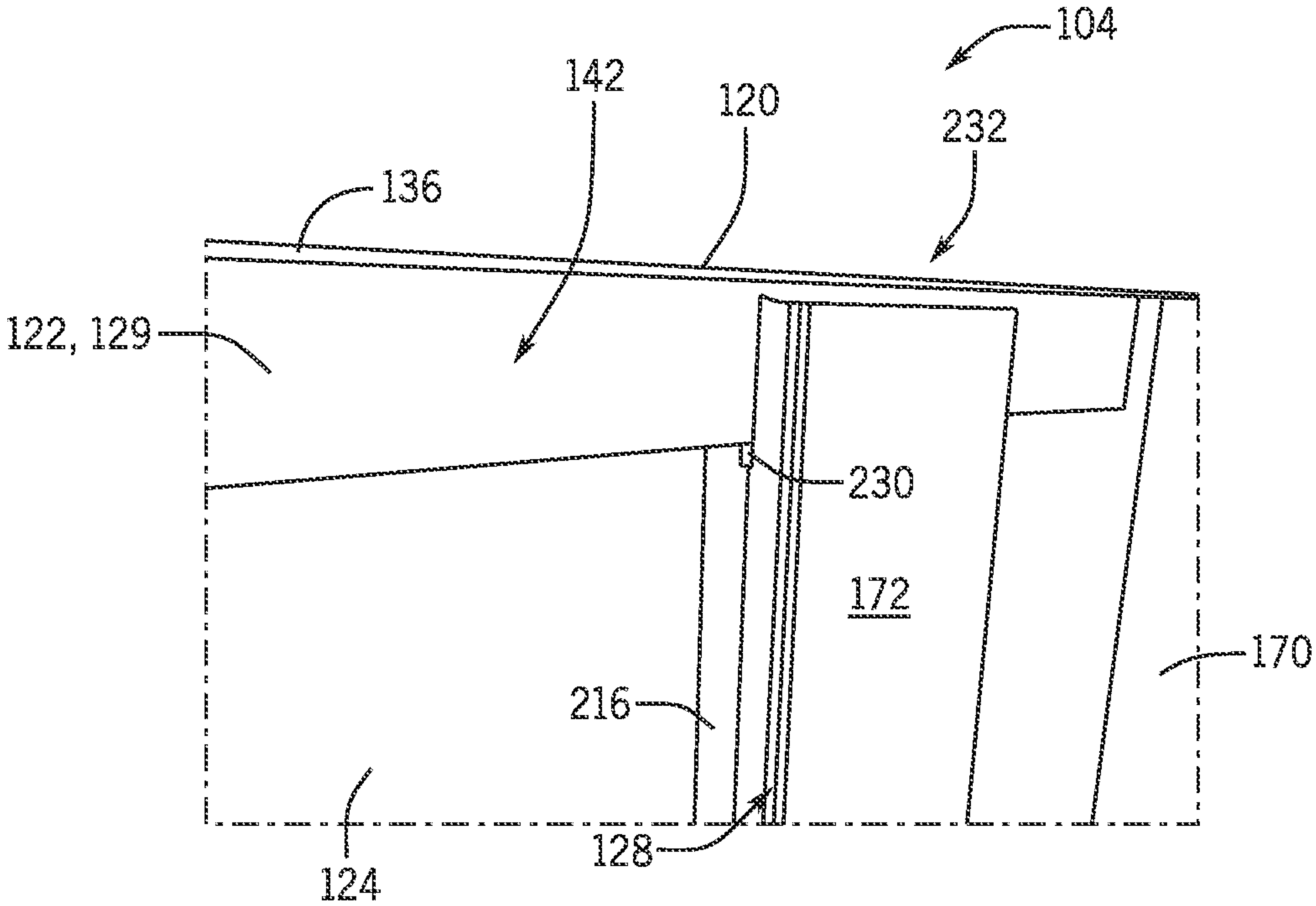
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FIG. 9

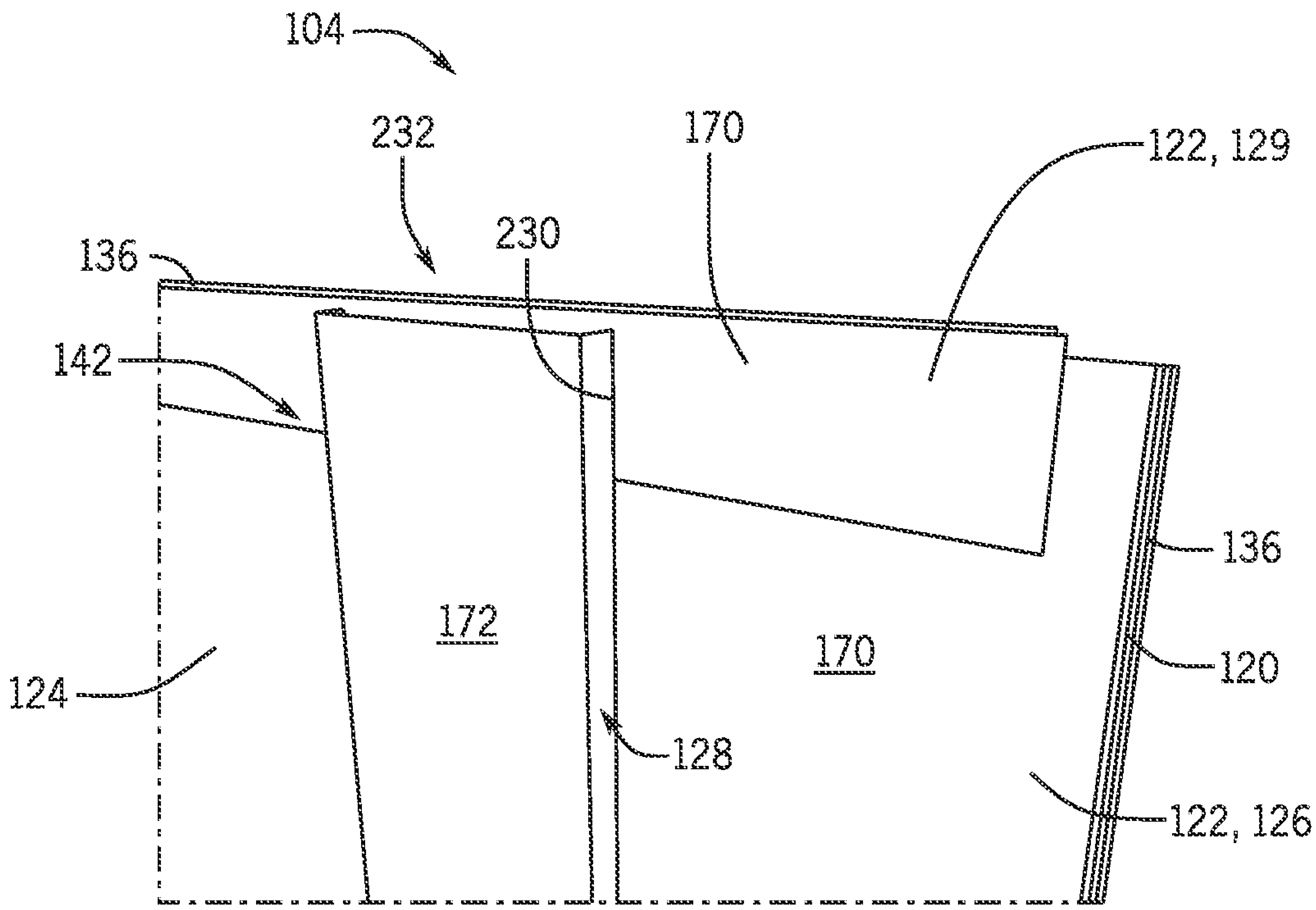
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FIG. 10

SIDE PANEL ASSEMBLY FOR ROOF TOP UNITS

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from and the benefit of India Provisional Application Serial No. 202011017103, entitled "A SIDE PANEL ASSEMBLY FOR ROOF TOP UNITS," filed Apr. 21, 2020, which is hereby incorporated by reference in its entirety for all purposes.

BACKGROUND

This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present disclosure, which are described below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

A heating, ventilation, and/or air conditioning (HVAC) system may be used to thermally regulate an environment, such as a space within a building, home, or other structure. The HVAC system generally includes a vapor compression system having heat exchangers, such as a condenser and an evaporator, which are fluidly coupled to one another via conduits of a refrigerant loop. A compressor may be used to circulate a refrigerant through the refrigerant loop to enable the transfer of thermal energy between components of the HVAC system (e.g., the condenser, the evaporator), the environment, and an air flow conditioned by the HVAC system for supply to a conditioned space (e.g., within a building).

The vapor compression system may be disposed within a housing of the HVAC system that is configured to receive an air flow, such as an outdoor air flow and a return air flow received from the conditioned space, to be conditioned by the HVAC system. The air flow may be directed through the housing to exchange thermal energy with the refrigerant circulated by the vapor compression system. To this end, the housing of the HVAC system may include wall panels that define a flow path of the air flow directed through the housing. In some applications, the wall panels may have a single wall construction. Such wall panels may form spaces or voids between the wall panels and components disposed within the housing, such a filter or heat exchanger. Unfortunately, the air flow may flow through the spaces or voids instead of through or across the components disposed within the housing, which may result in undesired (e.g., inefficient) operation of the HVAC system. In some systems, wall panels may have a double wall construction to reduce formation of spaces or voids between the wall panel and components within the housing. Unfortunately, wall panels having a double wall construction may be expensive, thereby leading to an increase in overall costs associated with manufacture of the HVAC system.

SUMMARY

A summary of certain embodiments disclosed herein is set forth below. It should be noted that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not

intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that may not be set forth below.

The present disclosure relates to a wall panel assembly for a heating, ventilation, and air conditioning (HVAC) unit. The wall panel assembly includes a panel having a main body, where the panel is configured to be fastened to a frame of the HVAC unit, and a plurality of stiffeners attached to the panel along a perimeter of the main body. A stiffener of the plurality of stiffeners includes a flat portion and a raised portion offset from the flat portion, where the raised portion is configured to sealingly engage with a component disposed within the HVAC unit.

The present disclosure also relates to a heating, ventilation, and air conditioning (HVAC) unit including a housing frame, a rack disposed within the housing frame, where the rack is configured to support conditioning equipment of the HVAC unit, and a wall panel assembly coupled to the housing frame. The wall panel assembly includes a single wall panel having a main body and includes a plurality of stiffeners coupled to the single wall panel and extending along a perimeter of the main body. The plurality of stiffeners includes an extended stiffener having a flat portion and a raised portion offset from the flat portion, where the raised portion is configured to create a sealing interface with the rack.

The present disclosure further relates to a wall panel assembly of a heating, ventilation, and air conditioning (HVAC) unit housing. The wall panel assembly includes a panel having a main body, where the panel is formed from a single sheet of material, and a plurality of stiffeners coupled to the panel at corresponding edges of the main body. Each stiffener of the plurality of stiffeners includes a flat portion extending along the main body, and a stiffener of the plurality of stiffeners includes a raised portion extending and offset from the flat portion of the stiffener, where the raised portion is configured to abut and sealingly engage with a component disposed within the HVAC unit housing.

BRIEF DESCRIPTION OF THE DRAWINGS

Various aspects of this disclosure may be better understood upon reading the following detailed description and upon reference to the drawings in which:

FIG. **1** is a perspective view of an embodiment of a building incorporating a heating, ventilation, and/or air conditioning (HVAC) system in a commercial setting, in accordance with an aspect of the present disclosure;

FIG. **2** is a perspective view of an embodiment of a packaged HVAC unit, in accordance with an aspect of the present disclosure;

FIG. **3** is a perspective view of an embodiment of a split, residential HVAC system, in accordance with an aspect of the present disclosure;

FIG. **4** is a schematic diagram of an embodiment of a vapor compression system used in an HVAC system, in accordance with an aspect of the present disclosure;

FIG. **5** is a partially exploded perspective view of an embodiment of an HVAC unit that includes a wall panel assembly having a liner portion configured to engage with an internal component of the HVAC unit, in accordance with an aspect of the present disclosure;

FIG. **6** is an exploded perspective view of an embodiment of a wall panel assembly of an HVAC unit, in accordance with an aspect of the present disclosure;

FIG. **7** is a side view of an embodiment of a wall panel assembly of an HVAC unit, in accordance with an aspect of the present disclosure;

FIG. **8** is a schematic of an embodiment of a portion of an HVAC unit, illustrating a wall panel assembly having a liner portion engaged with an internal component of the HVAC unit, in accordance with an aspect of the present disclosure;

FIG. **9** is a perspective view of an embodiment of a portion of a wall panel assembly, illustrating an assembled configuration of the wall panel assembly, in accordance with an aspect of the present disclosure; and

FIG. **10** is a perspective view of an embodiment of a portion of a wall panel assembly, illustrating an assembled configuration of the wall panel assembly, in accordance with an aspect of the present disclosure.

DETAILED DESCRIPTION

One or more specific embodiments of the present disclosure will be described below. These described embodiments are only examples of the presently disclosed techniques. Additionally, in an effort to provide a concise description of these embodiments, all features of an actual implementation may not be described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

When introducing elements of various embodiments of the present disclosure, the articles "a," "an," and "the" are intended to mean that there are one or more of the elements. The terms "comprising," "including," and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements. Additionally, it should be understood that references to "one embodiment" or "an embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features.

As briefly discussed above, a heating, ventilation, and/or air conditioning (HVAC) system may be used to thermally regulate a conditioned space within a building, home, or other suitable structure. For example, the HVAC system may include a vapor compression system that transfers thermal energy between a working fluid, such as a refrigerant, and a fluid to be conditioned, such as air. The vapor compression system includes a condenser and an evaporator that are fluidly coupled to one another via one or more conduits of a refrigerant loop or circuit. A compressor may be used to circulate the refrigerant through the conduits and other components of the refrigerant loop (e.g., an expansion device) and, thus, enable the transfer of thermal energy between components of the refrigerant loop (e.g., between the condenser and the evaporator) and one or more thermal loads (e.g., an environmental air flow, a return air flow, a supply air flow, etc.). The HVAC system may include additional components to enable conditioning of the fluid (e.g., air), such as filters configured to remove particles (e.g., dust, debris, etc.) within the fluid, louvers configured to control a quantity of the fluid directed through the HVAC system, and so forth. As used herein, "conditioning equipment" may refer to components of the HVAC system configured to enable conditioning of the fluid to be provided to the conditioned space, such as heat exchangers (e.g., evaporator, condenser, furnace, etc.) configured to exchange thermal energy with the fluid, filters configured to remove particles from the fluid, louvers configured to regulate an amount of the fluid directed through the HVAC system, elements (e.g., pads or sheets) configured to adjust a humidity of the fluid, and so forth.

Generally, the vapor compression system and related components (e.g., conditioning equipment, such as filters) may be disposed within one or more housings of the HVAC system. For example, in some embodiments, the HVAC system may be an outdoor unit (e.g., a rooftop unit, a single packaged unit) having a housing in which the conditioning equipment is disposed. However, in other embodiments, the HVAC system may be a split system having multiple, separate housings with associated components of the vapor compression system and/or conditioning equipment disposed therein. The housing may include a frame (e.g., a support structure) and one or more panels (e.g., wall panels) coupled to the frame, and the conditioning equipment may be disposed within an internal volume defined by the frame and wall panels. The housing may include one or more inlets and/or outlets configured to receive and/or discharge, respectively, an air flow utilized or conditioned by the HVAC system to produce conditioned air. The housing (e.g., wall panels) may direct the air flow through the HVAC system and across or through one or more components of the conditioning equipment, for example, to condition the air flow. Unfortunately, existing HVAC system housings may have panels, such as single wall panels, that form spaces or voids between the panels and conditioning equipment within the HVAC system across which the air flow is to be directed. Instead of flowing across the conditioning equipment, the air flow may flow through the spaces or voids, thereby bypassing the conditioning equipment. Thus, at least a portion of the air flow may not be conditioned (e.g., heated, cooled, dehumidified, filtered, etc.) as desired.

Accordingly, embodiments of the present disclosure are directed to a wall panel assembly for an HVAC system housing that is configured to engage with a component (e.g., conditioning equipment) disposed within the housing of the HVAC system to reduce, mitigate, avoid, and/or block formation of a space or void therebetween. Thus, the wall panel assembly disclosed herein mitigates bypass of air flow around the conditioning equipment, thereby enabling proper and/or desired operation of the HVAC system. For example, as discussed in detail below, the wall panel assembly may have a panel (e.g., single wall panel) and a plurality of stiffeners coupled thereto. The stiffeners may be configured to increase a structural rigidity of the wall panel assembly. A stiffener of the plurality of stiffeners may also include a liner portion configured to engage (e.g., sealingly engage) with the component disposed within the housing. In this way, a space or void between the wall panel assembly and the component is not formed, and all or substantially all air flow may be directed across the component (e.g., without bypassing the component). Additionally, the wall panel assembly having the panel and plurality of stiffeners described herein may not include a double wall construction (e.g., full double wall construction). Thus, present embodiments enable a reduction in air flow bypass within the housing while also avoiding an increase in costs associated with manufacture of HVAC systems. That is, the wall panel assembly disclosed herein provides a more cost-effective alternative to double wall panels utilized in conventional systems.

Turning now to the drawings, FIG. **1** illustrates an embodiment of a heating, ventilation, and/or air conditioning (HVAC) system for environmental management that employs one or more HVAC units in accordance with the present disclosure. As used herein, an HVAC system includes any number of components configured to enable regulation of parameters related to climate characteristics, such as temperature, humidity, air flow, pressure, air quality, and so forth. For example, an "HVAC system" as used herein is defined as conventionally understood and as further described herein. Components or parts of an "HVAC system" may include, but are not limited to, all, some of, or individual parts such as a heat exchanger, a heater, an air flow control device, such as a fan, a sensor configured to detect a climate characteristic or operating parameter, a filter, a control device configured to regulate operation of an HVAC system component, a component configured to enable regulation of climate characteristics, or a combination thereof. An "HVAC system" is a system configured to provide such functions as heating, cooling, ventilation, dehumidification, pressurization, refrigeration, filtration, or any combination thereof. The embodiments described herein may be utilized in a variety of applications to control climate characteristics, such as residential, commercial, industrial, transportation, or other applications where climate control is desired.

In the illustrated embodiment, a building **10** is air conditioned by a system that includes an HVAC unit **12** with a flash gas bypass system in accordance with present embodiments. The building **10** may be a commercial structure or a residential structure. As shown, the HVAC unit **12** is disposed on the roof of the building **10**; however, the HVAC unit **12** may be located in other equipment rooms or areas adjacent the building **10**. The HVAC unit **12** may be a single package unit containing other equipment, such as a blower, integrated air handler, and/or auxiliary heating unit. In other embodiments, the HVAC unit **12** may be part of a split HVAC system, such as the system shown in FIG. **3**, which includes an outdoor HVAC unit **58** and an indoor HVAC unit **56**.

The HVAC unit **12** is an air-cooled device that implements a refrigeration cycle to provide conditioned air to the building **10**. Specifically, the HVAC unit **12** may include one or more heat exchangers across which an air flow is passed to condition the air flow before the air flow is supplied to the building. In the illustrated embodiment, the HVAC unit **12** is a rooftop unit (RTU) that conditions a supply air stream, such as environmental air and/or a return air flow from the building **10**. After the HVAC unit **12** conditions the air, the air is supplied to the building **10** via ductwork **14** extending throughout the building **10** from the HVAC unit **12**. For example, the ductwork **14** may extend to various individual floors or other sections of the building **10**. In certain embodiments, the HVAC unit **12** may be a heat pump that provides both heating and cooling to the building with one refrigeration circuit configured to operate in different modes. In other embodiments, the HVAC unit **12** may include one or more refrigeration circuits for cooling an air stream and a furnace for heating the air stream.

A control device **16**, one type of which may be a thermostat, may be used to designate the temperature of the conditioned air. The control device **16** also may be used to control the flow of air through the ductwork **14**. For example, the control device **16** may be used to regulate operation of one or more components of the HVAC unit **12** or other components, such as dampers and fans, within the building **10** that may control flow of air through and/or from the ductwork **14**. In some embodiments, other devices may be included in the system, such as pressure and/or temperature transducers or switches that sense the temperatures and pressures of the supply air, return air, and so forth. Moreover, the control device **16** may include computer systems that are integrated with or separate from other building control or monitoring systems, and even systems that are remote from the building **10**.

FIG. **2** is a perspective view of an embodiment of the HVAC unit **12** that includes a flash gas bypass system in accordance with present embodiments. In the illustrated embodiment, the HVAC unit **12** is a single package unit that may include one or more independent refrigeration circuits and components that are tested, charged, wired, piped, and ready for installation. The HVAC unit **12** may provide a variety of heating and/or cooling functions, such as cooling only, heating only, cooling with electric heat, cooling with dehumidification, cooling with gas heat, or cooling with a heat pump. As described above, the HVAC unit **12** may directly cool and/or heat an air stream provided to the building **10** to condition a space in the building **10**.

As shown in the illustrated embodiment of FIG. **2**, a cabinet **24** encloses the HVAC unit **12** and provides structural support and protection to the internal components from environmental and other contaminants. In some embodiments, the cabinet **24** may be constructed of galvanized steel and insulated with aluminum foil faced insulation. Rails **26** may be joined to the bottom perimeter of the cabinet **24** and provide a foundation for the HVAC unit **12**. In certain embodiments, the rails **26** may provide access for a forklift and/or overhead rigging to facilitate installation and/or removal of the HVAC unit **12**. In some embodiments, the rails **26** may fit into "curbs" on the roof to enable the HVAC unit **12** to provide air to the ductwork **14** from the bottom of the HVAC unit **12** while blocking elements such as rain from leaking into the building **10**.

The HVAC unit **12** includes heat exchangers **28** and **30** in fluid communication with one or more refrigeration circuits. Tubes within the heat exchangers **28** and **30** may circulate refrigerant, such as R-410A, through the heat exchangers **28** and **30**. The tubes may be of various types, such as multichannel tubes, conventional copper or aluminum tubing, and so forth. Together, the heat exchangers **28** and **30** may implement a thermal cycle in which the refrigerant undergoes phase changes and/or temperature changes as it flows through the heat exchangers **28** and **30** to produce heated and/or cooled air. For example, the heat exchanger **28** may function as a condenser where heat is released from the refrigerant to ambient air, and the heat exchanger **30** may function as an evaporator where the refrigerant absorbs heat to cool an air stream. In other embodiments, the HVAC unit **12** may operate in a heat pump mode where the roles of the heat exchangers **28** and **30** may be reversed. That is, the heat exchanger **28** may function as an evaporator and the heat exchanger **30** may function as a condenser. In further embodiments, the HVAC unit **12** may include a furnace for heating the air stream that is supplied to the building **10**. While the illustrated embodiment of FIG. **2** shows the HVAC unit **12** having two of the heat exchangers **28** and **30**, in other embodiments, the HVAC unit **12** may include one heat exchanger or more than two heat exchangers.

The heat exchanger **30** is located within a compartment **31** that separates the heat exchanger **30** from the heat exchanger **28**. Fans **32** draw air from the environment through the heat exchanger **28**. Air may be heated and/or cooled as the air flows through the heat exchanger **28** before being released back to the environment surrounding the HVAC unit **12**. A blower assembly **34**, powered by a motor **36**, draws air through the heat exchanger **30** to heat or cool the air. The heated or cooled air may be directed to the building **10** by the ductwork **14**, which may be connected to the HVAC unit **12**. Before flowing through the heat exchanger **30**, the conditioned air flows through one or more filters **38** that may remove particulates and contaminants from the air. In certain embodiments, the filters **38** may be disposed on the air intake side of the heat exchanger **30** to prevent contaminants from contacting the heat exchanger **30**.

The HVAC unit **12** also may include other equipment for implementing the thermal cycle. Compressors **42** increase the pressure and temperature of the refrigerant before the refrigerant enters the heat exchanger **28**. The compressors **42** may be any suitable type of compressors, such as scroll compressors, rotary compressors, screw compressors, or reciprocating compressors. In some embodiments, the compressors **42** may include a pair of hermetic direct drive compressors arranged in a dual stage configuration **44**. However, in other embodiments, any number of the compressors **42** may be provided to achieve various stages of heating and/or cooling. As may be appreciated, additional equipment and devices may be included in the HVAC unit **12**, such as a solid-core filter drier, a drain pan, a disconnect switch, an economizer, pressure switches, phase monitors, and humidity sensors, among other things.

The HVAC unit **12** may receive power through a terminal block **46**. For example, a high voltage power source may be connected to the terminal block **46** to power the equipment. The operation of the HVAC unit **12** may be governed or regulated by a control board **48**. The control board **48** may include control circuitry connected to a thermostat, sensors, and alarms. One or more of these components may be referred to herein separately or collectively as the control device **16**. The control circuitry may be configured to control operation of the equipment, provide alarms, and monitor safety switches. Wiring **49** may connect the control board **48** and the terminal block **46** to the equipment of the HVAC unit **12**.

FIG. **3** illustrates a residential heating and cooling system **50**, also in accordance with present techniques. The residential heating and cooling system **50** may provide heated and cooled air to a residential structure, as well as provide outside air for ventilation and provide improved indoor air quality (IAQ) through devices such as ultraviolet lights and air filters. In the illustrated embodiment, the residential heating and cooling system **50** is a split HVAC system. In general, a residence **52** conditioned by a split HVAC system may include refrigerant conduits **54** that operatively couple the indoor unit **56** to the outdoor unit **58**. The indoor unit **56** may be positioned in a utility room, an attic, a basement, and so forth. The outdoor unit **58** is typically situated adjacent to a side of residence **52** and is covered by a shroud to protect the system components and to prevent leaves and other debris or contaminants from entering the unit. The refrigerant conduits **54** transfer refrigerant between the indoor unit **56** and the outdoor unit **58**, typically transferring primarily liquid refrigerant in one direction and primarily vaporized refrigerant in an opposite direction.

When the system shown in FIG. **3** is operating as an air conditioner, a heat exchanger **60** in the outdoor unit **58** serves as a condenser for re-condensing vaporized refrigerant flowing from the indoor unit **56** to the outdoor unit **58** via one of the refrigerant conduits **54**. In these applications, a heat exchanger **62** of the indoor unit functions as an evaporator. Specifically, the heat exchanger **62** receives liquid refrigerant, which may be expanded by an expansion device, and evaporates the refrigerant before returning it to the outdoor unit **58**.

The outdoor unit **58** draws environmental air through the heat exchanger **60** using a fan **64** and expels the air above the outdoor unit **58**. When operating as an air conditioner, the air is heated by the heat exchanger **60** within the outdoor unit **58** and exits the unit at a temperature higher than it entered. The indoor unit **56** includes a blower or fan **66** that directs air through or across the indoor heat exchanger **62**, where the air is cooled when the system is operating in air conditioning mode. Thereafter, the air is passed through ductwork **68** that directs the air to the residence **52**. The overall system operates to maintain a desired temperature as set by a system controller. When the temperature sensed inside the residence **52** is higher than the set point on the thermostat, or the set point plus a small amount, the residential heating and cooling system **50** may become operative to refrigerate additional air for circulation through the residence **52**. When the temperature reaches the set point, or the set point minus a small amount, the residential heating and cooling system **50** may stop the refrigeration cycle temporarily. The indoor unit **56** and/or the outdoor unit **58** includes a flash gas bypass system in accordance with present embodiments.

The residential heating and cooling system **50** may also operate as a heat pump. When operating as a heat pump, the roles of heat exchangers **60** and **62** are reversed. That is, the heat exchanger **60** of the outdoor unit **58** will serve as an evaporator to evaporate refrigerant and thereby cool air entering the outdoor unit **58** as the air passes over the outdoor heat exchanger **60**. The indoor heat exchanger **62** will receive a stream of air blown over it and will heat the air by condensing the refrigerant.

In some embodiments, the indoor unit **56** may include a furnace system **70**. For example, the indoor unit **56** may include the furnace system **70** when the residential heating and cooling system **50** is not configured to operate as a heat pump. The furnace system **70** may include a burner assembly and heat exchanger, among other components, inside the indoor unit **56**. Fuel is provided to the burner assembly of the furnace **70** where it is mixed with air and combusted to form combustion products. The combustion products may pass through tubes or piping in a heat exchanger, separate from heat exchanger **62**, such that air directed by the blower **66** passes over the tubes or pipes and extracts heat from the combustion products. The heated air may then be routed from the furnace system **70** to the ductwork **68** for heating the residence **52**.

FIG. **4** is an embodiment of a vapor compression system **72** that can be used in any of the systems described above. The vapor compression system **72** may circulate a refrigerant through a circuit starting with a compressor **74**. The circuit may also include a condenser **76**, an expansion valve(s) or device(s) **78**, and an evaporator **80**. The vapor compression system **72** may further include a control panel **82** that has an analog to digital (A/D) converter **84**, a microprocessor **86**, a non-volatile memory **88**, and/or an interface board **90**. The control panel **82** and its components may function to regulate operation of the vapor compression system **72** based on feedback from an operator, from sensors of the vapor compression system **72** that detect operating conditions, and so forth.

In some embodiments, the vapor compression system **72** may use one or more of a variable speed drive (VSDs) **92**, a motor **94**, the compressor **74**, the condenser **76**, the expansion valve or device **78**, and/or the evaporator **80**. The motor **94** may drive the compressor **74** and may be powered by the variable speed drive (VSD) **92**. The VSD **92** receives alternating current (AC) power having a particular fixed line voltage and fixed line frequency from an AC power source, and provides power having a variable voltage and frequency to the motor **94**. In other embodiments, the motor **94** may be powered directly from an AC or direct current (DC) power source. The motor **94** may include any type of electric motor that can be powered by a VSD or directly from an AC or DC power source, such as a switched reluctance motor, an induction motor, an electronically commutated permanent magnet motor, or another suitable motor.

The compressor **74** compresses a refrigerant vapor and delivers the vapor to the condenser **76** through a discharge passage. In some embodiments, the compressor **74** may be a centrifugal compressor. The refrigerant vapor delivered by the compressor **74** to the condenser **76** may transfer heat to a fluid passing across the condenser **76**, such as ambient or environmental air **96**. The refrigerant vapor may condense to a refrigerant liquid in the condenser **76** as a result of thermal heat transfer with the environmental air **96**. The liquid refrigerant from the condenser **76** may flow through the expansion device **78** to the evaporator **80**. In the illustrated embodiment, a flash gas bypass configuration in accordance with present embodiments is provided (as represented by the expansion device **78**) such that liquid refrigerant is delivered to the evaporator without any substantial amount of vapor refrigerant.

The liquid refrigerant delivered to the evaporator **80** may absorb heat from another air stream, such as a supply air stream **98** provided to the building **10** or the residence **52**. For example, the supply air stream **98** may include ambient or environmental air, return air from a building, or a combination of the two. The liquid refrigerant in the evaporator **80** may undergo a phase change from the liquid refrigerant to a refrigerant vapor. In this manner, the evaporator **80** may reduce the temperature of the supply air stream **98** via thermal heat transfer with the refrigerant. Thereafter, the vapor refrigerant exits the evaporator **80** and returns to the compressor **74** by a suction line to complete the cycle.

In some embodiments, the vapor compression system **72** may further include a reheat coil. In the illustrated embodiment, the reheat coil is represented as part of the evaporator **80**. The reheat coil is positioned downstream of the evaporator heat exchanger relative to the supply air stream **98** and may reheat the supply air stream **98** when the supply air stream **98** is overcooled to remove humidity from the supply air stream **98** before the supply air stream **98** is directed to the building **10** or the residence **52**. In certain embodiments, the vapor compression system **72** may include a flash gas bypass system as disclosed herein. In the illustrated embodiment of FIG. **4**, the flash gas bypass system is represented as part of the expansion device **78**.

It should be appreciated that any of the features described herein may be incorporated with the HVAC unit **12**, the residential heating and cooling system **50**, or other HVAC systems. Additionally, while the features disclosed herein are described in the context of embodiments that directly heat and cool a supply air stream provided to a building or other load, embodiments of the present disclosure may be applicable to other HVAC systems as well. For example, the features described herein may be applied to mechanical cooling systems, free cooling systems, chiller systems, or other heat pump or refrigeration applications.

As briefly discussed above, embodiments of the present disclosure are directed to a wall panel assembly for a housing of an HVAC system. The wall panel assembly is configured to engage with a component disposed within the housing, such as a component of conditioning equipment, to block bypass of air flow around the component. In particular, the wall panel assembly includes a panel (e.g., a single wall panel) and a plurality of stiffeners (e.g., reinforcing elements) coupled to the panel. Instead of including multiple wall panels with the wall panel assembly, a stiffener of the plurality of stiffeners also includes a liner portion that is configured to engage with the component within the housing. Thus, present embodiments enable a reduction in air flow bypass within the housing while also overcoming drawbacks (e.g., increased costs) associated with conventional systems.

To provide context for the following discussion, FIG. **5** is a perspective view of an embodiment of an HVAC system **100** having a housing **102** with wall panel assemblies **104** (e.g., single wall panel assemblies, partial double wall panel assemblies) in accordance with the present techniques. The HVAC system **100** may be configured to direct a flow of conditioned air (e.g., heated air, cooled air, dehumidified air) to a thermal load, such as a space within a building, residential home, or other suitable structure. It should be appreciated that the HVAC system **100** illustrated in FIG. **5** is simplified and intended to focus on the housing **102** having the wall panel assemblies **104**. However, the HVAC system **100** may also include embodiments and/or components of the HVAC unit **12** shown in FIGS. **1** and **2**, embodiments and/or components of the split residential heating and cooling system **50** shown in FIG. **3**, a rooftop unit (RTU), or any other suitable air handling unit or HVAC system.

The housing **102** of the HVAC system **100** may include a frame **106** (e.g., a housing frame, support structure, etc.) to which the wall panel assemblies **104** are coupled (e.g., secured, mounted, attached, etc.). For example, the frame **106** may be formed from rails (e.g., rails **26**), bars, beams, etc. coupled to one another to define a support structure of the HVAC system **100**. The housing **102** may also include additional panels **108** (e.g., wall panels, roof panels, access panels, base panels, etc.). The additional panels **108** may have a configuration (e.g., components, assemblies, etc.) similar to that of the wall panel assemblies **104** discussed in detail herein, or the additional panels **108** may have different configurations. The wall panel assemblies **104** and the additional panels **108** may be coupled to the frame **106** (e.g., via mechanical fasteners **107**) to define an interior volume **110** of the housing **102**. Conditioning equipment, such as the heat exchanger **30**, filters **38**, components of the vapor compression system **72**, and/or other components configured to adjust a quality and/or quantity of an air flow directed through the housing **102**, may be disposed within the interior volume **110**. The housing **102** is configured to receive one or more air flows and direct the one or more air flows through and/or across the conditioning equipment in order to produce a supply air flow that is discharged toward a conditioned space. For example, the housing **102** may be configured to receive an outdoor air flow, as indicated by arrow **112**, from an ambient environment surrounding the HVAC system **100** and/or a return air flow, as indicated by arrow **114**, from the conditioned space. The air flow(s) is directed through the housing **102** and across and/or through the conditioning equipment to produce the supply air flow that is discharged from the HVAC system **100** and supplied to the conditioned space.

In order to enable improved flow of the air flow through the housing **102**, the housing **102** includes the wall panel assemblies **104** of the present disclosure. As described in detail below, the wall panel assemblies **104** are configured to block bypass of the air flow around the conditioning equipment within the housing **102**. To this end, the wall panel assemblies **104** are configured to engage with (e.g., abut) a component **116** (e.g., internal component) within the housing **102**. For example, the component **116** may be a component of the conditioning equipment (e.g., a heat exchanger, such as heat exchanger **30**) or a structural component associated with the conditioning equipment. In some embodiments, the component **116** may be a rack or frame (e.g., support structure) configured to support a heat exchanger, such as the evaporator **80**, and/or a filter (e.g., filter **38**) of the HVAC system **100**. The wall panel assembly **104** engages (e.g., sealingly engages) with the component **116** to block formation of a space or void between the wall panel assembly **104** and the component **116** through which the air flow may otherwise flow and bypass the component **116** (e.g., conditioning equipment) within the housing **102**. For example, as shown in the illustrated embodiment, the housing **102** may include two wall panel assemblies **104** positioned on opposite sides of the housing **102** relative to the component **116**, and each wall panel assembly **104** may be configured to engage (e.g., sealingly engage) with the component **116** in the manner described in detail below. Thus, the wall panel assemblies **104** enable flow of the air flow (e.g., all or substantially all of the air flow) across the component **116**, as desired, instead of flowing around and/or bypassing the component **116**.

FIG. **6** is an exploded perspective view of an embodiment of the wall panel assembly **104**, illustrating various components configured to be assembled together to form the wall panel assembly **104**. In particular, the wall panel assembly **104** includes a panel **120**, a plurality of stiffeners **122**, and an insulation layer **124**. As described in further detail below with reference to FIGS. **7** and **8**, one or more of the stiffeners **122** (e.g., an extended stiffener **126**, elongated stiffener, sealing stiffener, retainers, etc.) is modified (e.g., relative to other stiffeners **122**) in accordance with the present techniques to enable engagement (e.g., airtight engagement) with the component **116** disposed within the housing **102**. For example, the extended stiffener **126** includes a profile or geometry (e.g., a stepped profile, a C-channel geometry, etc.) that defines a liner portion **128** configured to abut against the component **116** to mitigate formation of a space or void between the wall panel assembly **104** and the component **116** and thus block air flow therebetween. In some embodiments, remaining stiffeners **129** of the plurality of stiffeners **122** may not include the liner portion **128** of the extended stiffener **126**.

As shown, the panel **120** (e.g., wall panel) of the wall panel assembly **104** includes a sheet, plate, or other generally flat component that generally defines an overall height **130** and width **132** of the wall panel assembly **104**. The panel **120** may be a single panel (e.g., single piece) extending the height **130** and width **132** and may be formed from any suitable material, such as sheet metal. The panel **120** includes a main body **134** (e.g., single layer main body) and flanges **136** extending from the main body **134** about and/or along a perimeter **138** of the main body **134** (e.g., panel **120**). For example, the panel **120** may be formed from a single piece of sheet metal with the flanges **136** formed via cutting, bending, and/or another suitable manufacturing process. In an assembled configuration, the insulation layer **124** may be secured to the main body **134** of the panel **120**. For example, the insulation layer **124** may be formed from foam, rubber, foil, another suitable material, or any combination thereof. In some embodiments, the insulation layer **124** may be attached to the main body **134** via an adhesive.

The plurality of stiffeners **122** is also configured to be secured to the panel **120**. As will be appreciated, each stiffener **122** may be a rail, bar, or other strip of material (e.g., sheet metal) configured to reinforce the panel **120** and increase a structural rigidity (e.g., stiffness) of the wall panel assembly **104**. Additionally or alternatively, the plurality of stiffeners **122** may be retainers configured to secure the insulation layer **124** in place against the main body **134** of the panel **120**. For example, the plurality of stiffeners **122** may be attached or mounted to the flanges **136** extending from the main body **134**, such as via mechanical fasteners, such that each stiffener **122** is attached to the panel **120** on a respective edge or side of the panel **120** and/or main body **134**. Thus, the plurality of stiffeners **122** extends (e.g., cooperatively extends) generally along the perimeter **138** of the main body **134** (e.g., of the panel **120**). For example, the plurality of stiffeners **122** may include two horizontally oriented stiffeners **122** extending between two vertically oriented stiffeners **122**. In some embodiments, the components of the wall panel assembly **104** may be assembled such that the insulation layer **124** is captured (e.g., at least partially captured) between the panel **120** and the plurality of stiffeners **122**. In this way, the plurality of stiffeners **122** may secure the insulation layer **124** to the panel **120** (e.g., in addition to, or instead of, an adhesive disposed between the insulation layer **124** and the main body **134** of the panel **120**). However, it should be noted that some embodiments of the wall panel assembly **104** may not include the insulation layer **124**. Thus, the plurality of stiffeners **122** may be secured to the panel **120** to increase the structural rigidity of the wall panel assembly **104** without the insulation layer **124** therebetween.

In an assembled configuration, the wall panel assembly **104** has an external facing side **140** and an internal facing side **142**. When installed with the housing **102**, the external facing side **140** of the wall panel assembly **104** (e.g., the main body **134** of the panel **120**) is exposed to an environment surrounding the HVAC system **100**, and the internal facing side **142** is exposed to the interior volume **110** of the housing **102**. Specifically, the main body **134** of the panel **120** on the exterior facing side **140** may be exposed to the environment surrounding the HVAC system **100**. On the interior facing side **142**, the insulation layer **124** and the plurality of stiffeners **122** may be exposed to the interior volume **110** within the housing **102**. Thus, in the manner described below, the liner portion **128** of the extended stiffener **126** may abut the component **116** within the interior volume **110** to create a sealing engagement and/or sealing interface therebetween and enable improved direction of air flow across conditioning equipment within the housing **102**.

FIG. **7** is a side view of an embodiment of the wall panel assembly **104** in an assembled configuration, illustrating the interior facing side **142** of the wall panel assembly **104**. As described above, the plurality of stiffeners **122** is secured to the flanges **136** of the panel **120** along the perimeter **138** of the main body **134** and/or the panel **120**. Additionally, the plurality of stiffeners **122** captures (e.g., at least partially captures) the insulation layer **124** between the plurality of stiffeners **122** and the panel **120**. The plurality of stiffeners **122** may be secured to the flanges **126** via mechanical fasteners **160** (e.g., screws, rivets, nuts and bolts, etc.) or via another suitable securement technique. For example, each stiffener **122** may include holes (e.g., apertures, mounting holes) formed therein and configured to align with corresponding holes (e.g., apertures, mounting holes) formed in the flanges **136**. The mechanical fasteners **160** may extend through aligned holes of the stiffeners **122** and flanges **136** to secure the stiffeners **122** to the flanges **126**. The flanges **136** also include holes **162** (e.g., apertures, mounting holes) formed therein that are configured to align with corresponding holes (e.g., apertures, mounting holes) formed in the frame **106** of the housing **102** to enable mounting of the wall panel assembly **104** to the frame **106** (e.g., via mechanical fasteners, such as screws).

As shown in the illustrated embodiment, the plurality of stiffeners **122** secured to the panel **120** may at least partially overlap with one another in an assembled configuration of the wall panel assembly **104**. For example, horizontal stiffeners **164** (e.g., horizontally-oriented stiffeners, first stiffeners) of the plurality of stiffeners **122** may at least partially overlap with vertical stiffeners **166** (e.g., vertically-oriented stiffeners, second stiffeners) of the plurality of stiffeners **122**. In this way, a structural rigidity and/or stiffness of the wall panel assembly **104** may be reinforced and/or improved. Similarly, retention of the insulation layer **124** between the main body **134** of the panel **120** and the plurality of stiffeners **122** may be improved. The overlapping arrangement of the stiffeners **122** is described in further detail below with reference to FIGS. **9** and **10**.

As mentioned above, the plurality of stiffeners **122** includes the extended stiffener **126** (e.g., vertical stiffener **166**) having the liner portion **128** configured to abut and/or engage with the component **116** disposed within the interior volume **110** of the housing **102**. In the illustrated embodiment, each stiffener **122** includes a flat portion **170** (e.g., a flat surface) extending from the corresponding flange **136** to which the stiffener **122** is secured. In other words, the flat portion **170** extends generally inwardly from the perimeter **138** of the main body **134**. The flat portion **170** of each stiffener **122** is configured to abut against and/or extend along the insulation layer **124** secured against the main body **134** of the panel **120** and/or against the main body **134** to provide increased rigidity of the wall panel assembly **104**. The extended stiffener **126** also includes a raised portion **172** (e.g., a raised surface) extending from the flat portion **170** of the extended stiffener **126**. As described in further detail below with reference to FIG. **8**, the raised portion **172** of the extended stiffener **126** may define the liner portion **128** of the extended stiffener **126** configured to engage (e.g., abut) the component **116** within the housing **102**. To this end, the raised portion **172** of the extended stiffener **126** may be offset from the flat portion **170** of the extended stiffener **126** and/or offset from the insulation layer **124** or main body **134** in the assembled configuration of the wall panel assembly **104**.

Further, the flat portion **170** of each remaining stiffener **129** extends from the corresponding flange **136** (e.g., extends inwardly from the perimeter **138** of the main body **134**) by a dimension **174** (e.g., a width, a depth). The dimensions **174** of the flat portions **170** of the remaining stiffeners **129** may be the same or different from one another. A magnitude of the dimensions **174** of the flat portions **170** of the remaining stiffeners **129** may be selected based on a desired structural rigidity of the wall panel assembly **104**, a cost associated with manufacturing the wall panel assembly **104**, another suitable factor, or any combination thereof. As shown, the flat portions **170** of the remaining stiffeners **129** extend (e.g., extend inwardly) along a portion of the height **130** and/or the width **132** of the wall panel assembly **104** (e.g., by the dimension **174**), such that a portion of the insulating layer **124** is exposed (e.g., to the interior volume **110**) on the interior facing side **142** of the wall panel assembly **104** in the assembled and/or installed configuration.

The flat portion **170** of the extended stiffener **126** also includes a dimension **176** (e.g., a width, a depth) along which the flat portion **170** of the extended stiffener **126** extends from the corresponding flange **136** to which the extended stiffener **126** is secured. As shown, the dimension **176** of the flat portion **170** of the extended stiffener **126** may be greater than the respective dimensions **174** of the flat portions **170** of the remaining stiffeners **129**. As will be appreciated, a magnitude of the dimension **176** may be selected based on a desired position or location of the raised portion **172** of the extended stiffener **126** in an installed configuration of the wall panel assembly **104** with the housing **102**. For example, the magnitude of the dimension **176** may be selected such that the raised portion **172** of the extended stiffener **126** is aligned with and/or abuts the component **116** within the housing **102** in the installed configuration of the wall panel assembly **104** with the housing **102**. It should be noted that, similar to flat portions **170** of the remaining stiffeners **129**, the flat portion **170** and the raised portion **172** of the extended stiffener **126** extend along a portion of the width **132** of the wall panel assembly **104** instead of extending along an entirety of the width **132**. In this way, the wall panel assembly **104** including the features described herein enables improved direction of air flow within the housing **102** (e.g., via sealing engagement between the wall panel assembly **104** and the component **116**) at reduced manufacturing costs compared to conventional double wall panels. That is, present embodiments of the wall panel assembly **104** do not include a full double wall construction (e.g., two wall panels extending an entirety of the height **130** and width **132**) and may therefore be manufactured more cost effectively than traditional wall panels having a double wall configuration.

FIG. **8** is a schematic of an embodiment of the wall panel assembly **104** installed with the housing **102** of the HVAC system **100**, illustrating engagement between the wall panel assembly **104** and the component **116** disposed within the interior volume **110** of the housing **102**. For example, the component **116** may be a component of the conditioning equipment, a rack or other structural support configured to support a heat exchanger (e.g., evaporator **80**), support a filter (e.g., filter **38**) of the HVAC system **100**, a component of the conditioning equipment, and/or other component of the HVAC system **100** across which an air flow is to be directed.

As described above, the wall panel assembly **104** may be coupled to the frame **106** (e.g., rails **26**, base rails, vertical rails, top rails, bottom rails, etc.) of the housing **102** via the flanges **136** of the panel **120**. The plurality of stiffeners **122** is also secured to the panel **120** via the flanges **136**. Specifically, each flange **136** includes a crosswise extension **200** (e.g., a first portion) extending (e.g., extending crosswise) from the main body **134** and a lateral extension **202** (e.g., a second portion) extending (e.g., extending crosswise) from the crosswise extension **200**. The lateral extension **202** may extend generally parallel (e.g., within one, two, three, four, or five degrees) with the main body **134** of the panel **120** and includes the holes **162** configured to receive mechanical fasteners therethrough to secure the wall panel assembly **104** to the frame **106** (e.g., via holes **204** formed in the frame **106**). The crosswise extension **200** of each flange **136** may also include holes **206** (e.g., apertures, mounting holes, slots) formed therein to enable mounting of the stiffeners **122** to the panel **120**. Specifically, each stiffener **122** may include a mounting portion **208** (e.g., mounting flange) extending from the respective flat portion **170** of the stiffener **122** and including holes **210** (e.g., apertures, mounting holes, slots). The holes **210** of the mounting portion **208** may align with the holes **206** formed in the crosswise extension **200** of the flange **136** to which the stiffener **122** is secured, and fasteners (e.g., mechanical fasteners **160**) may extend through the holes **206**, **210** to secure the stiffener **122** to the panel **120**. In this way, the wall panel assembly **104** may be assembled without formation of holes, apertures, or other openings in the main body **134** of the panel **120**, which may reduce ingress and/or egress of fluid (e.g., air, moisture, etc.) into or out of the housing **102** via the wall panel assembly **104**. However, in some embodiments, certain stiffeners **122** and/or flanges **136** of the wall panel assembly **104** may not include the holes **206** and/or **210**, and the stiffeners **122** may be secured to the panel **120** in the manner described below with reference to FIGS. **9** and **10** or in another suitable manner.

The embodiment of FIG. **8** also illustrates engagement between the extended stiffener **126** and the component **116** within the housing **102**. As mentioned above, the component **116** may be a heat exchanger rack, a filter rack, or another rack or support structure configured to support conditioning equipment (e.g., filters **38** and/or evaporator **80**) of the HVAC system **100**. The extended stiffener **126** includes the liner portion **128** generally defined by the raised portion **172** of the extended stiffener **126**. The liner portion **128** and/or the raised portion **172** extending from the flat portion **170** may have a generally C-channel and/or C-shaped geometry, as shown. As mentioned above, the raised portion **172** (e.g., raised surface, elevated surface) is offset from the flat portion **170** of the extended stiffener **126** (e.g., in a direction perpendicular or crosswise to the width **132** of the wall panel assembly **104**), such that the raised portion **172** is raised and/or elevated from the insulation layer **124** and/or main body **134** of the panel **120**. An offset dimension **212** of the raised portion **172** may be selected based on an arrangement of the component **116** within the housing **102** (e.g., relative to the wall panel assembly **104**) to enable abutment (e.g., sealing engagement) between the extended stiffener **126** (e.g., raised portion **172**) and the component **116** in the installed configuration. Thus, when installed with the housing **102** and the HVAC system **100**, the raised portion **172** (e.g., C-channel) may engage (e.g., sealingly engage) with the component **116** disposed within the interior volume **110** of the housing **102** (e.g., to block air flow therebetween).

In some embodiments, the extended stiffener **126** and/or the HVAC system **100** may include additional features to enable desired abutment and/or engagement between the extended stiffener **126** and the component **116**. For example, in the illustrated embodiment, as gasket **214** is positioned between the component **116** and the raised portion **172** of the extended stiffener **126**. The gasket **214** may be formed from foam, rubber, or other suitable material (e.g., compressible material, resilient material) and may be attached to the component **116** (e.g., via adhesive). In other embodiments, the gasket **214** may be secured to the raised portion **172** of the extended stiffener **126**. When installed, the raised portion **172** may be biased and/or positioned against the gasket **214** to create a sealing engagement (e.g., airtight seal) between the extended stiffener **126** and the component **116**. In the illustrated embodiment, the extended stiffener **126** also includes a lateral extension **216** (e.g., of and/or extending from the liner portion **128**). The lateral extension **216** may be generally aligned with the flat portion **170** of the extended stiffener **126** and is configured to abut against the insulation layer **124** in the assembled configuration of the wall panel assembly **104**. The lateral extension **216** may enable proper alignment of the raised portion **172** and/or engagement between the raised portion **172** and the component **116** (e.g., gasket **214**) in the installed configuration of the wall panel assembly **104** with the housing **102** and the HVAC system **100**. Further, in some embodiments, a dimension **222** (e.g., a width) of the raised portion **172** may be greater than a dimension **224** (e.g., a width) of the component **116**. As a result, the liner portion **128** may provide an installation tolerance for the wall panel assembly **104** while providing a desired sealing engagement between the wall panel assembly **104** and the component **116**.

As discussed above, the features of the extended stiffener **126** described herein are configured to enable desired direction of air flow through the housing **102** of the HVAC system **100**. In particular, the extended stiffener **126** is configured to engage with the component **116** disposed within the housing **102** to block bypass of air flow around the component **116** (e.g., between the wall panel assembly **104** and the component **116**, represented by arrow **218**). For example, the component **116** may be a filter rack configured to support one or more filters **220** of the HVAC system **100**. Abutment between the raised portion **172** of the extended stiffener **126** and the component **116** may therefore promote flow of the air flow through and/or across the filters **220** instead of around the filters **220** (e.g., bypassing the filters **220**). In this way, all or substantially all of the air flow may flow through the filters **220**. Additionally, abutment between the raised portion **172** of the extended stiffener **126** and the component **116** (e.g., filter rack) may promote proper alignment of the filters **220** within the filter rack (e.g., component **116**). As noted above, the component **116** may be another element of the HVAC system **100**, such as a heat exchanger rack configured to support a heat exchanger, and the extended stiffener **126** may engage with the component **116** to block bypass of air between the component **116** and the wall panel assembly **104**.

FIGS. **9** and **10** are partial perspective views of an embodiment of the wall panel assembly **104**, illustrating an arrangement of stiffeners **122** secured to the panel **120** on the interior facing side **142** of the wall panel assembly **104**. As mentioned above, the plurality of stiffeners **122** extends along the perimeter **138** (e.g., outer boundary) of the main body **134** of the panel **120** and may at least partially overlap with one another in an assembled configuration of the wall panel assembly **104**. To enable overlap of remaining stiffeners **129** (e.g., horizontally oriented stiffeners **122**, **164**) with the extended stiffener **126** having the liner portion **128** (e.g., raised portion **172**), the extended stiffener **126** may include one or more slots **230** (e.g., slits) formed therein. Specifically, as shown in FIGS. **9** and **10**, slots **230** may be formed between the flat portion **170** and the liner portion **128** (e.g., raised portion **172**) and/or between the liner portion **128** (e.g., raised portion **172**) and the lateral extension **216** of the extended stiffener **126**. In particular, the slots **230** may be formed at an end **232** of the extended stiffener **126** and may be sized (e.g., dimensioned) to accommodate one of the remaining stiffeners **129**. Similar slots **230** may be formed in an end of the extended stiffener **126** opposite the end **232** for receiving another remaining stiffener **129** (e.g., horizontally oriented stiffener **122**, **164**) coupled to the panel **120**.

A dimension (e.g., height or length) of the slots **230** along the extended stiffener **126** may correspond to the dimension **174** of the flat portion **170** of the remaining stiffener **129** positioned adjacent to the extended stiffener **126**. Thus, in the assembled configuration, the slots **230** may receive the flat portion **170** of the remaining stiffener **129** to which the extended stiffener **126** is adjacent, such that the remaining stiffener **129** captures the lateral extension **216** and/or the flat portion **170** of the extended stiffener **126** against the insulation layer **124** and/or the main body **134** of the panel **120**. Therefore, the remaining stiffener **129** may secure the extended stiffener **126** to the panel **120** in the assembled configuration illustrated (e.g., without mechanical fasteners extending through holes **208**, **210** associated with the extended stiffener **126**). However, the liner portion **128** (e.g., the raised portion **172**) may be disposed outward from the remaining stiffener **129** (e.g., relative to the main body **134** of the panel **120**), such that the raised portion **172** may engage with the component **116** (e.g., the gasket **214**) within the housing **102** in the installed configuration of the wall panel assembly **104**. In this way, the plurality of stiffeners **122** including the extended stiffener **126** may be assembled with one another to capture the insulation layer **124** against the panel **120** and provide the raised portion **172** configured to engage with the component **116**.

As set forth above, embodiments of the present disclosure may provide one or more technical effects useful for directing air flow through a housing of an HVAC system, such as by blocking bypass of air flow around a component (e.g., a filter, a heat exchanger, etc.) disposed within the housing. In particular, embodiments of the present disclosure are directed to a wall panel assembly configured to engage with a component (e.g., conditioning equipment, a support structure of conditioning equipment) disposed within the housing of the HVAC system to reduce, mitigate, avoid, and/or block formation of a space or void therebetween through which air may otherwise flow. Thus, the wall panel assembly disclosed herein mitigates bypass of air flow around the conditioning equipment, thereby enabling proper and/or desired operation of the HVAC system. For example, the wall panel assembly may have a panel (e.g., single wall panel) and a plurality of stiffeners coupled thereto. The stiffeners may be configured to increase a structural rigidity of the wall panel assembly and/or retain an insulation layer of the wall panel assembly against the panel. A stiffener of the plurality of stiffeners may also include a liner portion configured to engage (e.g., sealingly engage) with the component disposed within the housing. In this way, a space or void between the wall panel assembly and the component is not formed, and all or substantially all air flow may be directed across the component (e.g., without bypassing the component through a space or void). Additionally, the wall panel assembly having the panel and plurality of stiffeners described herein may not include a double wall construction (e.g., full double wall construction). Thus, present embodiments enable a reduction in air flow bypass within the housing while also reducing costs associated with manufacture of HVAC systems.

While only certain features and embodiments have been illustrated and described, many modifications and changes may occur to those skilled in the art, such as variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, such as temperatures and pressures, mounting arrangements, use of materials, colors, orientations, and so forth, without materially departing from the novel teachings and advantages of the subject matter recited in the claims. The order or sequence of any process or method steps may be varied or re-sequenced according to alternative embodiments. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the disclosure. Furthermore, in an effort to provide a concise description of the exemplary embodiments, all features of an actual implementation may not have been described, such as those unrelated to the presently contemplated best mode, or those unrelated to enablement. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation specific decisions may be made. Such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure, without undue experimentation.

The techniques presented and claimed herein are referenced and applied to material objects and concrete examples of a practical nature that demonstrably improve the present technical field and, as such, are not abstract, intangible or purely theoretical. Further, if any claims appended to the end of this specification contain one or more elements designated as "means for [perform]ing [a function] . . . " or "step for [perform]ing [a function] . . . ", it is intended that such elements are to be interpreted under 35 U.S.C. 112(f). However, for any claims containing elements designated in any other manner, it is intended that such elements are not to be interpreted under 35 U.S.C. § 112(f).

The invention claimed is:

1. A wall panel assembly for a heating, ventilation, and air conditioning (HVAC) unit, comprising:

a panel comprising a main body, wherein the panel is configured to be fastened to a frame of the HVAC unit; and

a plurality of stiffeners attached to the panel along a perimeter of the main body, wherein a stiffener of the plurality of stiffeners comprises a flat portion and a raised portion offset from the flat portion, wherein the raised portion is configured to sealingly engage with a component disposed within the HVAC unit.

2. The wall panel assembly of claim **1**, wherein the panel comprises a plurality of flanges extending from the main body along the perimeter of the main body, and each stiffener of the plurality of stiffeners is attached to a corresponding flange of the plurality of flanges.

3. The wall panel assembly of claim **2**, wherein each flange comprises a first portion extending crosswise from the main body and a second portion extending crosswise from the first portion, each stiffener of the plurality of stiffeners is attached to the first portion of the corresponding flange of the plurality of flanges, and the second portion of each flange of the plurality of flanges is configured to be fastened to the frame of the HVAC unit.

4. The wall panel assembly of claim **1**, comprising an insulation layer disposed against the main body of the panel.

5. The wall panel assembly of claim **4**, wherein the insulation layer is secured to the main body of the panel via an adhesive.

6. The wall panel assembly of claim **4**, wherein the insulation layer is at least partially captured between the main body of the panel and the plurality of stiffeners attached to the panel.

7. The wall panel assembly of claim **1**, wherein the plurality of stiffeners at least partially overlaps with one another.

8. The wall panel assembly of claim **7**, wherein the stiffener of the plurality of stiffeners comprises a slot formed therein between the flat portion and the raised portion, and wherein an additional stiffener of the plurality of stiffeners extends through the slot of the stiffener.

9. The wall panel assembly of claim 1, wherein the panel is formed from a single piece of sheet metal.

10. A heating, ventilation, and air conditioning (HVAC) unit, comprising:

a housing frame;

a support rack disposed within the housing frame, wherein the support rack is configured to support conditioning equipment of the HVAC unit; and

a wall panel assembly coupled to the housing frame, wherein the wall panel assembly comprises:

a single wall panel comprising a main body; and

a plurality of stiffeners coupled to the single wall panel and extending along a perimeter of the main body, wherein the plurality of stiffeners comprises an extended stiffener comprising a flat portion and a raised portion offset from the flat portion, and wherein the raised portion is configured to create a sealing interface with the support rack.

11. The HVAC unit of claim 10, wherein the support rack is a filter rack, and the conditioning equipment comprises at least one filter configured to filter an air flow directed through the HVAC unit.

12. The HVAC unit of claim 10, comprising a gasket attached to the support rack, wherein the raised portion abuts the gasket.

13. The HVAC unit of claim 10, wherein the wall panel assembly comprises an insulation layer, and the insulation layer is at least partially captured between the single wall panel and the plurality of stiffeners.

14. The HVAC unit of claim 13, wherein the insulation layer is at least partially exposed to an interior volume of the HVAC unit.

15. The HVAC unit of claim 13, wherein the plurality of stiffeners comprises additional stiffeners, the extended stiffener and the additional stiffeners cooperatively extend along the perimeter of the main body, each additional stiffener comprises a respective flat portion, and the flat portion of the extended stiffener and the respective flat portions of the additional stiffeners compress the insulation layer against the main body of the single wall panel.

16. The HVAC unit of claim 15, wherein the single wall panel comprises a plurality of flanges extending from the main body, each stiffener of plurality of stiffeners is attached to a corresponding flange of the plurality of flanges, the flat portion of the extended stiffener extends from the corresponding flange attached to the extended stiffener by a first dimension, the respective flat portion of each additional stiffener extends from the corresponding flange attached to the additional stiffener by a respective second dimension, and the first dimension is greater than the respective second dimensions.

17. A wall panel assembly of a heating, ventilation, and air conditioning (HVAC) unit housing, comprising:

a panel comprising a main body, wherein the panel is formed from a single sheet of material; and

a plurality of stiffeners coupled to the panel at corresponding edges of the main body, wherein each stiffener of the plurality of stiffeners comprises a flat portion extending along the main body, and a stiffener of the plurality of stiffeners comprises a raised portion extending and offset from the flat portion of the stiffener, wherein the raised portion is configured to abut and sealingly engage with a component disposed within the HVAC unit housing.

18. The wall panel assembly of claim 17, comprising an insulation layer disposed against the main body of the panel, wherein the plurality of stiffeners secures the insulation layer against the main body of the panel, and the plurality of stiffeners at least partially overlaps with one another.

19. The wall panel assembly of claim 17, wherein the stiffener of the plurality of stiffeners comprises a slot formed therein between the flat portion and the raised portion of the stiffener, and an additional stiffener of the plurality of stiffeners extends through the slot.

20. The wall panel assembly of claim 17, wherein the component disposed within the HVAC unit housing comprises a rack configured to support a filter, an evaporator, or both disposed within the HVAC unit housing, and wherein the wall panel assembly is configured to be mounted to a lateral side of the HVAC unit housing.

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